



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
-----------------	-------------	----------------------	---------------------	------------------

10/646,709

08/25/2003

Sadayuki Ohnishi

Q76993

9821

23373 7590 02/12/2008
SUGHRUE MION, PLLC
2100 PENNSYLVANIA AVENUE, N.W.
SUITE 800
WASHINGTON, DC 20037

EXAMINER

CAO, PHAT X

ART UNIT

PAPER NUMBER

2814

MAIL DATE

DELIVERY MODE

02/12/2008

PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/646,709	OHNISHI, SADAYUKI	
	Examiner	Art Unit	
	Phat X. Cao	2814	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 16 November 2007.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 27-32, 34 and 35 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 27-32, 34 and 35 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some * c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. _____ |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Claim Rejections - 35 USC § 103

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

2. Claims 27, 29-32, and 34-35 are rejected under 35 U.S.C. 103(a) as being unpatentable over Barth et al (US. 2004/0173908) in view of Lauterbach et al (US 6,313,517).

Regarding claims 27 and 29-30, Barth (Fig. 1) discloses a semiconductor substrate 10, and a metal wiring 15 and an interlayer dielectric film (17,18,19) which are formed on the semiconductor substrate 10, the interlayer dielectric film (17,18,19) including a multi-layered structure consisting of: a diffusion barrier film 17 preventing diffusion of the metal out of the metal wiring 15 (par. [0006], last 3 lines), an adhesive film 18 (par. [0007]) formed directly on the diffusion barrier film 17, and a low dielectric constant film 19 of polymeric thermoset material (i.e., SILK) (par. [0008], lines 1-7) formed directly on the adhesive film 18, the low dielectric constant film 19 (or 119 in Fig. 2) being constituted essentially by an organic low dielectric constant material having a specific dielectric constant not greater than 4 (par. [0031]), and the organic low dielectric constant material 19 (Fig. 1) or 119 (Fig. 2) being a silicon-containing organic compound of

Art Unit: 2814

methyilsilsequioxane or SiOC (par. [0031]), and the diffusion barrier film 17 containing silicon (i.e., silicon nitride, par. [0006], last 3 lines).

Barth does not disclose that the adhesive film 18 is a silicon-based compound having an aromatic ring.

However, Lauterbach (column 3, lines 35-66 through column 4, lines 1-16) teaches the well-known feature of having polymer benzocyclobutene film being a silicon-containing organic compound having an aromatic ring (see formula at column 4) for providing a good adhesion to the metal wiring layer/dielectric layer (column 4, lines 10-13). Accordingly, in view of teaching of Barth that the adhesive film can be composed of any material suitable for enhancing adhesion of the dielectric layer (par. [0033]) and in view of teaching of Lauterbach that the benzocyclobutene silicon-based compound having an aromatic ring provides the good adhesion to the metal wiring/dielectric layer (column 4, lines 10-13), it would have been obvious to form the adhesive film 18 of Barth with the silicon-based compound material as set forth above because such silicon-containing organic compound BCB adhesive layer would provide a good adhesion to the metal wiring layer/organic dielectric layer, as taught by Lauterbach (column 4, lines 10-13).

Regarding claim 31, Lauterbach (column 3, lines 50-66 through column 4, lines 1-16) also teaches the forming of an adhesive BCB, the adhesive BCB is a polymer silicon-based compound formed through polymerization of a monomer containing a divinylsiloxane bisbenzocyclobutene unit.

Regarding claims 32 and 34, Barth further discloses that the organic low dielectric constant material 19 (Fig. 1) or 119 (Fig. 2) is a silicon-containing organic compound of methylsilsequioxane or SiOC (par. [0031]).

Regarding claim 35, Barth's Fig. 1 also discloses the interlayer dielectric film (17,18,19) is formed on the metal wiring 15.

3. Claim 28 is rejected under 35 U.S.C. 103(a) as being unpatentable over Barth et al and Lauterbach et al as applied to claim 27 above, and further in view of Applicant's admitted prior art.

Barth discloses the diffusion barrier film 17 being made of SiN (par. [0006], last 3 lines), but does not disclose the diffusion barrier film 17 being made of SiCN.

However, Applicant's admitted prior art (Fig. 3) teaches the contact structure including a diffusion barrier film 108 of SiCN formed on a metal wiring 106. Accordingly, it would have been obvious to substitute SiN with SiCN because they both have the same function as a diffusion barrier film for preventing diffusion of the metal out of the metal wiring.

Response to Arguments

4. In regard to the combination of Barth and Lauterbach, Applicant argues that one skilled in the art would not have been motivated to use the silicon-containing BCB in Lauterbach as an adhesion promoting layer 18 of Barth for the purpose of obtaining the adhesion to the dielectric layer 19.

This argument is not persuasive because in view of teaching of Barth that the adhesive film can be composed of any material suitable for enhancing adhesion of the dielectric layer 19 (par. [0033]) and in view of teaching of Lauterbach that the benzocyclobutene silicon-based compound would provide the good adhesion to the metal wiring/dielectric layer (column 4, lines 10-13), one skilled in the art would have been motivated to combine the references as suggested.

Conclusion

5. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be

Art Unit: 2814

calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

6. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Phat X. Cao whose telephone number is 571-272-1703. The examiner can normally be reached on M-F.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Wael Fahmy can be reached on 571-272-1705. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/P. X. C./
Primary Examiner, Art Unit 2814

/Phat X Cao/
Primary Examiner, Art Unit 2814

2/6/08

